

VERSION WITH MARKINGS TO SHOW CHANGES MADE:

IN THE SPECIFICATION:

Amend Paragraph [0014] as follows:

[0014] -- FIG. 3 is a winding diagram of a strand of a two-layer winding with the slot number $N = 9$ slots; ~~and~~--.

Amend Paragraph [0015] as follows:

[0015] -- FIG. 4 is a fragmentary section view of a stator of the synchronous motor according to the present invention; and

FIG. 5 is a schematic perspective diagram of a motor having a rotor and a stator with a slot skew γ .--.

Add the following paragraph after [0026] and before [0027]:

-- FIG. 5 is a schematic perspective view of a motor with a stator 42 and a rotor 41. The rotor 41 includes permanent magnets 40 which are arranged on the outer circumference of the rotor. The angle γ (reference numeral 50) subtended on the periphery of the stator in the axial direction between the longitudinal axis of the stator and the longitudinal direction of the stator slots is referred to as "slot skew". --.

IN THE CLAIMS:

Amend the following claim:

4. (Amended) The synchronous motor of claim 1, wherein the stator includes a laminated core with a plurality of slots, each slot defining a slot gap and a slot width, wherein a width of the slot skew of gap is at least half of the a slot pitch width.

REMARKS

The last Office Action of November 2, 2001 has been carefully considered. Reconsideration of the instant application in view of the foregoing amendments and the following remarks is respectfully requested.

Claims 1 to 6 are pending in the application.

It is noted that the drawings are objected to because of applicant's failure to show every feature set forth in the claims.

Claims 1-3 and 5 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Japanese Pat. No. JP 62-185545 (hereinafter "Koichi") in view of U.S. Pat. No. 3,673,477 (hereinafter "Broadway et al.").

Claims 4 and 6 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Koichi in view of Broadway et al. and further in view of U.S. Pat. No. 5,030,864 (hereinafter "Van Hout et al.").

OBJECTION TO THE DRAWING

The objection to the drawings under 37 CFR 1.83(a) has been noted. However, it is applicant's contention that the submission of a drawing to illustrate the rotor configuration recited in claims 5 and 6 is not necessary for an understanding of the invention. (35 U.S.C. §113 states that "applicant shall furnish a drawing where necessary for the understanding of the subject matter sought to be patented."). For example, a rotor with an outer circumference and

including permanent magnets which are arranged on the outer circumference of the rotor (claim 5) is shown in Fig. 1 of JP 62-185545 cited by the examiner. Likewise, permanent magnets which are arranged interiorly of the rotor, are depicted, for example, in FIG. 2 of U.S. Patent 5,030,864 cited by the examiner, and in FIG. 2 of U.S. Patent 5,091,668. Accordingly, those skilled in the relevant art will be able to recognize the features recited in claims 5 and 6 without the benefit of a drawing.

Applicant also submits that the term "slot skew" recited in claim 1 is known in the art and denotes the angle subtended on the periphery of the stator in the axial direction between the longitudinal axis of the stator and the longitudinal direction of the stator slots. To clarify the meaning, applicant has included a new FIG. 5 which shows the definition of the skew angle γ . The new FIG. 5 is merely intended to define terminology used in the relevant art and does not introduce new matter. FIG. 5 also shows the rotor in a configuration known from JP 62-185545 discussed *supra*.

The specification have been amended to reflect the incorporation of new FIG. 5.

Applicant respectfully requests that the examiner withdraw the objections to the drawings under 37 CFR 1.83(a).

REJECTION UNDER 35 U.S.C. §103(a)

The rejection of claims 1-3 and 5 under 35 U.S.C. §103(a) as being unpatentable over Koichi in view of Broadway et al. is hereby traversed and reconsideration thereof is respectfully requested in view of remarks set forth below.

Independent claim 1 is directed to a permanent excited synchronous motor with a stator. The stator has a winding, which includes cyclically repeating factors $|\xi_p| = 0.945$, $|\xi_{5p}| = 0.140$, and $|\xi_{7p}| = 0.060$, and a skew angle $\gamma = \frac{2\pi}{18p}$, wherein p is the number of pole pairs. Claims 2-6 depend from claim 1.

Koichi discloses a 4-pole permanent magnet rotary electric machine with a field core 1, permanent magnets 21-24, an armature core 3, an armature winding 4, and teeth 51-59. The stator has NS = 9 slots. None of the Figs. 1-5 of Koichi teaches the specific arrangement of the stator windings, which is shown in detail in Figs. 1 and 2 of the present invention and corresponds to the winding factors $|\xi_{ip}|$ recited in claim 1, nor does Koichi teach the recited skew angle. However, applicant notes that Koichi teaches a 4-pole motor.

The winding factors are optimized for optimum operating performance of the motor, taking into consideration the field distribution at the fundamental frequency as well as at the harmonic frequencies. This results in different winding criteria depending on the application. The winding arrangement of the present invention is optimized for suppression of harmonic content.

The reference to Broadway et al., unlike the present invention which is directed to a permanent-magnet excited motor, describes a pole-changing induction motor. This is an entirely different motor design, and none of the embodiments disclosed in the '477 patent remotely suggest the winding pattern recited in claim 1. Although Broadway refers to the "necessity to minimize the risk of trouble by designing production machines for minimum harmonic content" (col. 2, lines 9-10), he does not suggest a winding pattern of the type disclosed in claim 1.

With respect to claim 2, Broadway actually teaches away from using an odd number of slots, which according to Broadway "may not be the ideal coil-pitch for the elimination of harmonics." (col. 2, lines 37-38). Note that Fig. 2 of the present invention discloses the use of 9 slots. Accordingly, not only do Koichi and Broadway, taken either alone or in combination, fail to disclose, teach or suggest the subject matter recited in claim 1, but those skilled in the art would have no motivation to combine Koichi and Broadway to arrive at the two-layer winding with 9 slots recited in claim 2.

Accordingly, Applicant respectfully requests that the rejection of claim 1 be withdrawn. Claims 2, 3 and 5 which depend from amended claim 1 should also be patentable over the Koichi and Broadway et al. references for the same reason that claim 1 is patentable.

Applicant also wishes to point out that a motor winding can be optimized in many ways to satisfy various criteria. For example, a winding can be optimized to provide an optimum field at the fundamental frequency, either with a minimum

harmonic contribution or with a controlled harmonic field. This results in different winding factors and different winding patterns, which are not predictable simply by extrapolation from a winding pattern known in the art.

Claims 4 and 6 were rejected under 35 U.S.C. §103(a) as being unpatentable over Koichi in view of Broadway et al. and further in view of van Hout et al.

Claim 4 has been amended to correct a typographical error. Claim 4 now recites that the width of the slot gap (and not the "slot skew") is at least half of the slot width. This change is supported in paragraph [0022] of the specification, which states that "the gap 25 has a width which is at least half the width W of the slot 22".

Van Hout et al. disclose a three-phase electrical machine, in particular a DC motor, which avoids skewing of the poles and instead defines a particular extent of the air gap in the tangential direction. However, the Van Hout et al. reference does not specify the winding arrangement and hence does not disclose subject matter material for the patentability of claim 1. Since claim 4 depends from claim 1, claim 4 should also be patentable over the Koichi, Broadway and Van Hout references, either taken alone or in combination, for the same reason that claim 1 is patentable.

Since none of the references of record, either taken alone or in combination, anticipate the subject matter recited in claim 1, Applicant therefore respectfully requests that the Examiner reconsider and withdraw all outstanding rejections and objections.

CONCLUSION

Applicant believes that when the Examiner reconsiders the claims in the light of the above comments, he will agree that the invention is in no way properly met or anticipated or even suggested by any of the references however they are considered.

In view of the above presented remarks and amendments, it is respectfully submitted that all claims on file should be considered patentably differentiated over the art and should be allowed.

Reconsideration and allowance of the present application are respectfully requested.

Should the Examiner consider necessary or desirable any formal changes anywhere in the specification, claims and/or drawing, then it is respectfully requested that such changes be made by Examiner's Amendment, if the Examiner feels this would facilitate passage of the case to issuance. If the Examiner feels that it might be helpful in advancing this case by calling the undersigned, applicant would greatly appreciate such a telephone interview.

Respectfully submitted,

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